DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 08/13/2011 have been fully considered but they are not persuasive.

With regards to claims 1 and 2, applicants argue that the combination of Motoki and Ito do not render obvious having a gallium nitride semiconductor substrate with a mirror like surface. Applicants allege that Ito teaches utilizing an SOI substrate rather than a GaN substrate. However, as applicants pointed out, ¶114 of Ito clearly states that the semiconductor layer may comprise of GaN. Whether implication is in play here, Ito explicitly recites that GaN can be utilized and therefore Ito teaches utilizing GaN substrates. Therefore, this argument is unpersuasive.

Applicants' addition of new claims 15 and 16 are also not sufficient to overcome the prior art of record. Claims 15 and 16 seem to merely take an (X, Y) (i.e. contaminant, photoluminescence) value and conjure up numerical values from that given point utilizing arbitrary formulas. There is also indication that both claims 15 and 16 present a hypothetical situation which ultimately does not limit the scope of the invention. Both claims 15 and 16 recite "when the ratio of the photoluminescence at the maximum contaminant-density level…[the photoluminescence] is from 1 to about 13 times that standard" This limitation does not further limit the scope of the claim but instead merely stipulates a hypothetical situation.

Furthermore, claim 16 is suspect of 35 U.S.C. 112, new matter issues because of its extrapolation of an arbitrary (X,Y) point on the graph presented in the Fig. 3.

Applicants' extrapolation of the selected point of photoluminescence at a given x value (i.e. 50 x 10^{10}) is not accurate. Examiner submits that this extrapolation is speculative and that it cannot be concretely judged to be at 4400. In fact, could this photoluminescence point probably be at 4450 or even at 4300? No one can tell. Therefore, the uncertainty presented by this extrapolation subjects at least claim 16 to 35 U.S.C. 112, first paragraph new matter issues.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 15 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 15 is highly dependent on the extrapolation of the photoluminescence from the given value of 5 x 10^{11}. However, this extrapolation is very speculative and it is clearly not shown that the photoluminescence at 5 x 10^{11} is 4400.

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 2, 11, 12, 15, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Motoki et al. (USP# 6,468,347 B1, hereinafter Motoki) and further in view of Ito.

With regards to claim 1, Motoki teaches a gallium-nitride semiconductor substrate having a mirrorlike, planar surface directly onto which a light-emitting-device-forming film has been epitaxially grown (see Fig. 21a-Fig. 21e).

Motoki, however, does not teach the gallium-nitride substrate therein contaminated at the interface between the mirrorlike, planar surface and the device-forming film grown thereon by one or more elements selected from Si, Cr, Mn, Fe, Ni, Cu, Zn and Al at a density level of from 15×10^{10} to 10×10^{11} atoms/cm^2.

In the same field of endeavor, Ito teaches a cleaning method wherein nickel impurities are removed from the surface of an SOI to a level lower than the claimed range (see ¶40, 1×10^9 atoms/cm^2 obtained on surface of SOI), wherein the SOI could be a GaN layer (see ¶114). One of ordinary skill would strive to achieve the lowest level of metal contamination possible in order to prevent short circuiting effects or other layer mishaps. Furthermore, if a lower level of metal contamination that the one claimed can be achieved according to Ito, then one of ordinary skill may certainly achieve the claimed range.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to utilize the method of Ito to produce contaminant levels claimed since Ito clearly demonstrated that lower contaminant levels can be achievable. One of ordinary skill would strive to achieve the lowest level of metal contamination possible in order to prevent short circuiting effects or other layer mishaps. Furthermore, if a lower level of metal contamination that the one claimed can be achieved according to Ito, then one of ordinary skill may certainly achieve the claimed range.

With regards to claim 2, Motoki teaches a gallium-nitride semiconductor substrate having a mirrorlike, planar surface directly onto which a light-emitting-device-forming film has been epitaxially grown (see Fig. 21a-Fig. 21e).

Motoki, however, does not teach the gallium-nitride substrate therein contaminated at the interface between the mirrorlike, planar surface and the device-forming film grown thereon by one or more elements selected from Si, Cr, Mn, Fe, Ni, Cu, Zn and Al at a density level of from 15×10^{10} to 5×10^{11} atoms/cm^2.

In the same field of endeavor, Ito teaches a cleaning method wherein nickel impurities are removed form the surface of an SOI to a level lower than the claimed range (see ¶40, 1×10^9 atoms/cm^2 obtained on surface of SOI), wherein the SOI could be a GaN layer (see ¶114). One of ordinary skill would strive to achieve the lowest level of metal contamination possible in order to prevent short circuiting effects or other layer mishaps. Furthermore, if a lower level of metal contamination that the one claimed can

be achieved according to Ito, then one of ordinary skill may certainly achieve the claimed range.

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With regards to claims 11 and 12, Motoki teaches a gallium-nitride semiconductor substrate as set forth in claims 1 and 2, wherein the substrate surface on which the device-forming epitaxial film has been grown is a complex of faces in which Ga is exposed, and faces in which N is exposed (the gallium nitride substrate taught by Motoki will have exposed faces of gallium atoms and nitrogen atoms when the structure of gallium nitride is viewed at the atomic level).

With regards to claim 15, Motoki and Ito teaches a gallium-nitride semiconductor substrate as set forth in claim 1, having a photoluminescence in terms of said contaminant-density level that, when the ratio of the photoluminescence at the maximum contaminant-density level of 10×10^{11} atoms/cm2 to said maximum

contaminant-density level is taken as a standard at unity, is from 1 to about 13 times that standard (hypothetical situations do not further limit the scope of the claim, see MPEP 2106, II(c)).

With regards to claim 16, Motoki and Ito teaches a gallium-nitride semiconductor substrate as set forth in claim 2, having a photoluminescence in terms of said contaminant-density level that, when the ratio of the photoluminescence at the maximum contaminant-density level of 5 x 10^{11} atoms/cm2 to said maximum contaminant-density level is taken as a standard at unity, is from 1 to about 4.4 times that standard (hypothetical situations do not further limit the scope of the claim, see MPEP 2106, II(c)).

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAE LEE whose telephone number is (571)270-1224. The examiner can normally be reached on Monday - Friday, 7:30 a.m. - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Richards can be reached on 571-272-1736. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner, Art Unit 2895

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